

REMARKS

Claims 25 and 28-48 are currently pending in this application. This Amendment amends the specification and independent claims 25 and 33. Support for the amendments to the specification and claims can be found in the specification, claims, and drawings as originally filed. No new matter has been added.

The Examiner has objected to the specification for improper antecedent basis because the limitations found in claim 37 are not disclosed in the specification. The specification has been amended to include the limitations found in claim 37. Support for the amendment to the specification can be found in claim 37 and on page 2, lines 32-35 of the specification as originally filed.

The Examiner has rejected claims 25 and 28-34 under 35 U.S.C. § 112, second paragraph, for indefiniteness. The Examiner asserts that the recitation “and defining a stable surface composition layer” in independent claims 25 and 33 is unclear as to which layer (i.e., the gold film or the sulfur layer) is considered stable. Claims 25 and 33 have been amended to include the amendatory language “and defining a stable deposited plasma layer”. Support for the amendments to claims 25 and 33 can be found in Tables 1 and 7 on pages 7 and 11, respectively, of the specification.

The present invention, as claimed in amended independent claim 25, is directed to a device for investigating reactions between interactive chemical or biological species. The device includes a substrate and a plasma layer. The substrate includes a film of free electron metal that consists essentially of gold. The plasma layer includes sulfur plasma which is deposited directly on the gold film of the substrate and defines a stable plasma deposited layer. None of the cited prior art references, including the newly cited Meade et al. reference, teaches or suggests a sulfur plasma layer deposited directly onto a gold surface, as claimed.

The Examiner has rejected claim 25 under 35 U.S.C. § 102(e) for anticipation by U.S. Patent No. 6,291,188 to Meade et al. (hereinafter “the Meade patent”). The Examiner asserts that the Meade patent includes a substrate comprising a film of gold and a sulfur layer deposited directly on the substrate. Applicants respectfully traverse the asserted rejection.

The Meade patent provides for the selected covalent modification of nucleic acids with redox active moieties, such as transition metal complexes (Abstract). The Meade patent includes metallic solid supports comprising blocking moieties and modified nucleic acids. The blocking moieties having at least a first end and a second end are attached at the first end to the metallic surface. The modified nucleic acids comprise a linker moiety having a first end and a second end. The first end of the linker moiety is attached to the solid support and the second end is attached to the nucleic acid (column 2, lines 13-22). The solid support can have a surface that has a metallic layer, such as gold (column 3, lines 14-18). A sulfur-containing moiety contains a sulfur atom which may be used to attach the blocking moiety at one end to the metallic solid support (column 4, lines 13-17). The manner in which the sulfur-containing moieties are attached to the metallic surface is by contacting the sulfur-containing moieties with the metal (column 12, lines 60-63). The Meade patent does not teach or suggest the plasma deposition from the gas phase of sulfur-containing compounds onto a gold film of a substrate.

Independent claim 25 has been amended to include sulfur plasma deposited directly on the gold film of the substrate. Support for the amendment to claim 25 can be found in original claim 37 and in Examples 1-10 of the specification, in which the substrate is placed in a plasma reactor. As previously discussed, claim 25 has also been amended to clarify that it is the deposited plasma layer that is stable. In view of the above amendments to claim 25, the Meade patent does not teach or suggest sulfur plasma deposited directly onto the gold film of the substrate or the resultant stable plasma deposited layer. Accordingly, reconsideration and withdrawal of the asserted anticipation rejection of claim 25 over Meade et al. is respectfully requested.

The Examiner has rejected claims 25, 28-34, 37-40, 44, 45, and 48 under 35 U.S.C. § 103(a) for obviousness over the teachings of European Patent No. 0 104 608 to Dunn et al. (hereinafter "the Dunn patent") in view of the Meade patent. The Examiner asserts that the Dunn patent teaches the claimed invention except for the teaching of a film of gold on the substrate and the plasma layer deposited directed on the substrate. The Examiner combines the Dunn patent with the Meade patent for the asserted teaching of depositing sulfur directly to a metallic surface. Therefore, the Examiner contends that it would have been obvious to one of ordinary skill in the art to deposit sulfur moieties directly onto a gold film as taught by the Meade patent into the method and apparatus of the Dunn patent in order

to provide covalent attachment of the sulfur to the metallic gold film. Applicants respectfully traverse this asserted rejection of the claims.

The Dunn patent is directed to a method for chemically modifying a surface of organic and/or inorganic substrates for the attachment of large molecules having available functional groups, such as proteins (see page 1, lines 1-10). Further, the surface of the substrate is irreversibly modified by grafting specific chemical functional groups onto the surface with a plasma of a suitable material, such as sulfur (see page 5, lines 13-20). Moreover, Dunn discloses that the surfaces to be modified can be made of inorganic materials, such as non-metals, metals and metal oxide. However, the list of inorganic materials on page 8, line 27 to page 9, line 5 does not include gold. Therefore, Dunn does not disclose the treatment of a gold substrate with a plasma layer that comprises a sulfur.

As previously discussed, the Meade patent requires a particular orientation of both the sulfur-containing moiety and the terminal groups X (i.e., Formula 1, column 4, lines 1-10) or the nucleic acid (i.e., Formula 2, column 8, lines 10-18). The terminal groups of the Meade patent are chosen to modulate the interaction between the nucleic acid and the blocking moieties on the surface wherein these terminal groups are used to influence the exposed surface of the monolayer. For example, the terminal groups may be negatively charged groups, effectively forming a negatively charged surface such that when the probe or target nucleic acid is DNA or RNA, the nucleic acid is repelled or prevented from lying down on the surface to facilitate hybridization (column 5, lines 46-61). Because of the nature of plasma polymerization as discussed below, Meade et al. orientation of the terminal groups cannot possibly be attributable to plasma deposition, and Meade et al. cannot disclose or teach the present claims.

Plasma is a direct consequence of the ionization of the gases present in a plasma reactor and fragmentation, which is a secondary process that leads to polymerization. The chemical reactions in this secondary process are complex and non-specific in nature. The combination and recombination of free radicals formed by fragmentation of a monomer form high molecular weight compounds, namely polymers. Plasma polymerization generally takes place in a low pressure and low temperature plasma that is produced by a glow discharge through an organic gas or vapor. Plasma polymerization depends on the monomer flow rate, system pressure, and discharge power among other variable parameters, such as the geometry of the system, the reactivity of the starting monomer, the frequency of the

excitation signal, and the temperature of the substrate. The overall power input in plasma polymerization is used for creating the plasma and for fragmentation of the monomer. Under plasma conditions, the monomer molecules undergo fragmentation and deposit polymer molecules onto a solid surface. However, the plasma polymer does not contain regularly repeating units (e.g., the chains are branched and are randomly terminated with a high degree of crosslinking). The free radicals trapped in the film continue to react and change the polymer network over time. Crosslinking reactions also occur on the surface or in the bulk of the newly forming plasma polymer. Further, some elements and groups in the original monomer may be absent in the resulting polymer. Also, the film may change due to the reaction with oxygen and water vapor in the atmosphere. Because of the numerous and unpredictable crosslinking reactions occurring on the surface during plasma polymerization, the use of gas plasma deposition cannot be considered to have been somehow inherently disclosed by the Meade patent because of the specific orientation of the terminal groups of the sulfur-containing moiety required for attachment of the nucleic acid, according to Meade et al.

Another reason why the Meade patent does not disclose gas plasma deposition is that the sulfur-containing moieties of Meade et al. (column 4, lines 17-18) have a very low volatility. By contrast, higher volatility sulfur compounds are used for plasma deposition according to the claimed invention, see specification at page 4, lines 26-33. Therefore, there is no teaching, suggestion, or motivation in the Meade patent to deposit sulfur plasma directly onto a gold substrate. Because claims 28-32, 34, 37-40, 44, and 45 depend either directly or indirectly from amended independent claims 25 or 33, reconsideration and withdrawal of the rejections of claim 25, 28-34, 37-40, 44, 45, and 48 are respectfully requested.

Regarding the asserted obviousness rejection of claim 35 over the Dunn patent and the Meade patent in view of U.S. Patent No. 5,723,219 to Kolluri et al. (hereinafter "the Kolluri patent"), the Examiner relies on the Kolluri patent for the teaching of the use of the gas monomer and plasma polymerization techniques. Claim 35 depends directly from amended independent claim 33 and is thus allowable over the teachings of the Dunn patent and the Meade patent for the reasons discussed above.

Regarding the obviousness rejection of claim 36 over Dunn patent and the Meade patent in view of U.S. Patent No. 5,932,296 to Sluka et al. (hereinafter "the Sluka patent"), the Examiner relies on the Sluka patent for the teaching of the step of cleaning the

substrate by means of a pulse argon plasma before the application of the functional groups to the substrate. However, claim 36 depends directly from claim 33 and is allowable over the teachings of the Dunn patent and the Meade patent for the reasons discussed above.

Regarding the obviousness rejection of claims 41-43, 46, and 47 over the Dunn patent and the Meade patent in view of U.S. Patent No. 5,991,488 to Salamon et al. (hereinafter "the Salamon patent"), the Examiner relies on the Salamon patent for the teaching of a surface plasmon resonance spectroscopy. Claims 41-43, 46, and 47 depend either directly or indirectly from independent claim 33 and are believed to be allowable over the teachings of the Dunn patent and the Meade patent for the same reasons as discussed above.

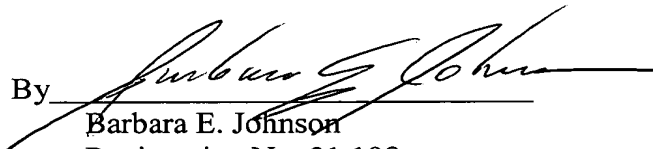
CONCLUSION

In view of the foregoing, Applicants believe that claims 25 and 28-48 are patentable over the prior art of record and are in condition for allowance. Reconsideration and withdrawal of the Examiner's rejections and allowance of claims 25 and 28-48 are respectfully requested.

Respectfully submitted,

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